

UNIVERSITI TEKNOLOGI MARA

**DEVELOPMENT OF PALM PUREE
FROM DIFFERENT TENERA BREEDS
AND ITS EFFECT ON THE
STABILITY, PHYSICO-CHEMICAL
PROPERTIES AND ACCEPTABILITY
OF BISCUIT**

HASWANI MAISARAH BINTI MUSTAFA

Thesis submitted in fulfillment
of the requirements for the degree of
Master of Science


Faculty of Applied Sciences

January 2014

AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulation for Post Graduate, Universiti Teknologi MARA regulating the conduct of my study and research.

Name of Student	:	Haswani Maisarah Binti Mustafa
Student I.D. No.	:	2008326085
Programme	:	Master of Science (AS780)
Faculty	:	Applied Sciences
Thesis Title	:	Development of Palm Puree from Different Tenera Breeds and Its Effect On The Stability, Physico-chemical Properties and Acceptability of Biscuit
Signature of Student	:	
Date	:	January 2014

ABSTRACT

The health-promoting benefits and natural goodness of new developed food product of Palm Puree (PP) which is associated with antioxidant properties provide new information on its uses in food applications. Two Tenera breeds from *Elaeis guineensis* Jacq. oil palm fruit species were used in the preparation of PP, namely T24 and T99. Percentage yield of mesocarp of breed T24 was found to be significantly higher ($p < 0.05$) than T99. Each breed was formulated with two different PP formulations which consist of 2% mesocarp fibre with 98% crude palm oil (formulation A) and 5% mesocarp fibre with 95% crude palm oil (formulation B). Four formulations were developed and labeled as PP24A, PP24B, PP99A and PP99B. This study consists of two phases. The first phase is to develop canned PP and determine the antioxidant properties, physico-chemical characteristics and shelf-life stability. The samples were investigated for their antioxidant properties by using various assays such as Total Phenolic Content (TPC), Total Flavonoid Content (TFC), Total Carotenoid Content (TCC), Ferric Reducing Antioxidant Power (FRAP), 1,1-diphenyl-2-picrylhydrazyl (DPPH) free radical scavenging activity and Oxygen Radical Absorption Capacity (ORAC). The second phase was to develop biscuit from PP24A and PP24B which were stored for 12 weeks at room temperature and study on physico-chemical properties which includes shelf-life stability and sensory characteristics were conducted. The results revealed that both formulations of PP from T24 (PP24A and PP24B) exhibited significantly higher ($p < 0.05$) TPC and TFC than formulations of PP from T99 (PP99A and PP99B). However, TCC of PP99A and PP99B were found significantly higher ($p < 0.05$) than PP24A and PP24B. TPC and TFC of PP24A and PP24B also showed strong correlations with FRAP and free radical scavenging activity with values significantly higher ($p < 0.05$) than PP99A and PP99B. The quantitative analysis for phenolic acids showed the presence of gallic, *p*-hydroxybenzoic, caffeic, vanillic, syringic, coumaric and ferulic. While four vitamin E derivatives identified were α -Tocopherol (α -T), α -Tocotrienol (α -T₃), γ -Tocotrienol (γ -T₃) and δ -Tocotrienol (δ -T₃). Shelf-life study on all canned PP showed to be microbiologically safe with good oxidative stability throughout 12 months of storage. Five formulations which consist of biscuit without addition of PP (control or F1), biscuit added with 5% PP24A (PP24A-5 or F2), biscuit added with 10% PP24A (PP24A-10 or F3), biscuit added with 5% PP24B (PP24B-5 or F4) and biscuit added with 10% PP24B (PP24B-10 or F5) were developed. The results revealed that F1 exhibited lowest ($p < 0.05$) oxidative stability compared to other formulations. However, all biscuits incorporated with PP were able to maintain their oxidative stability until 12 weeks of storage period. All PP biscuits were able to show better microbial stability compared to control biscuit until 12 weeks of storage. The physical analysis also demonstrated a decreased in L*, a* and b* values and an increased in pH values in all biscuit formulations. From the sensory evaluation, PP biscuits were accepted by the panelists and comparable to F1. Hence, the newly developed PP can be a potential source of natural food antioxidant and functional ingredient which can be incorporated in bakery product such as biscuit.

TABLE OF CONTENTS

	Page
AUTHOR'S DECLARATION	ii
ABSTRACT	iii
ACKNOWLEDGEMENT	iv
TABLE OF CONTENTS	v
LIST OF TABLES	x
LIST OF FIGURES	xi
LIST OF ABBREVIATIONS	xiii
CHAPTER ONE: INTRODUCTION	1
1.1 Background	1
1.2 Significance of the Study	2
1.3 Problem Statement	3
1.4 Objectives	3
CHAPTER TWO: LITERATURE REVIEW	4
2.1 Oil Palm Fruit	4
2.2 Mesocarp Fibre	5
2.3 Palm Oil	6
2.4 Oil Palm Products	8
2.5 Puree	8
2.6 Functional Food	10
2.6.1 Functional Ingredient in Bakery Product	10
2.6.2 Effect of Functional Ingredient Incorporated Into Bakery Products	11
2.7 Dietary Fibre (DF)	12
2.8 Antioxidants	14
2.8.1 Mechanism of Antioxidant	15
2.8.1.1 Primary (Chain-Breaking) Antioxidant	16
2.8.1.2 Secondary (Preventive) Antioxidant	17

2.8.2	Natural Antioxidants	18
2.8.2.1	Vitamin E	18
2.8.2.2	Carotenoids	20
2.8.2.3	Flavonoids	21
2.8.2.4	Phenolic Acids	23
2.8.3	Natural Occurrence of Tocopherols and Tocotrienols in Foods	24
2.8.4	Natural Antioxidants for Protecting Foods	25
2.9	Shelf-Life Stability	26
2.9.1	Lipid Oxidation	26
2.9.2	Types of Lipid Oxidation	27
2.9.2.1	Autooxidation	28
2.9.2.2	Photo-oxidation	28
2.9.3	Mechanism of Lipid Oxidation	29
2.9.3.1	Initiation	29
2.9.3.2	Propagation	30
2.9.3.3	Termination	30
2.9.4	Measurement of Oxidative Deterioration and Oxidative Stability	31
2.9.4.1	Peroxide Value (PV)	31
2.9.4.2	Thiobarbituric Acid (TBA)	32
2.9.4.3	Volatile Compound Using Gas Chromatography (GC)	33
2.9.5	Microbial Stability	35
CHAPTER THREE: METHODOLOGY		37
3.1	Materials	37
3.1.1	Raw Materials	37
3.1.2	Chemicals and Reagents	37
3.2	Development of Palm Puree (PP)	38
3.2.1	Processing of Palm Fruits	38
3.2.2	Sterilisation	38
3.2.3	Separation of Pulp, Kernel and Fibre	38